



Major Topics of School Algebra

Trainer of Trainers Module
Montana Office of Public
Instruction



Montana
Office of Public Instruction
Denise Juneau, State Superintendent

Group Norms

Listening: SLANT

Cell phone reminder

Conversations

Breaks



Bathroom location



Montana
Office of Public Instruction
Denise Juneau, State Superintendent

Activity

- Think about an adjective that describes you that begins with the same letter your first name begins with
- Share with the group one at a time around the room



Montana
Office of Public Instruction
Denise Juneau, State Superintendent



The Major Topics of School Algebra

The National Mathematics Advisory Panel Report identifies the major topics of school algebra.

Selected Major Topics*



Symbols and Expressions

- Polynomial and rational expressions
- Arithmetic and finite geometric series



Linear Equations

- Real numbers as points on the number line
- Linear equations/inequalities and their graphs
- Systems of simultaneous linear equations



Quadratic Equations

- Factors/factoring of quadratic polynomials
- Completing the square in quadratic expressions
- Quadratic formula



Functions

- Linear, quadratic, and polynomial functions
- Nonlinear functions (e.g., square and cube root functions; absolute value; step functions)
- Exponential, logarithmic, and trigonometric functions



Algebra of Polynomials

- Roots and factorization of polynomials
- Complex numbers and operations
- Fundamental theorem of algebra



Combinatorics and Finite Probability

- Applications of the binomial theorem and Pascal's Triangle

Practice 1: Topics of Algebra



- Teach for understanding of topics of school algebra
- Make linkages among topics
- Develop problem-solving skills
- Enhance teacher understanding
- Address misconceptions in learning algebra

Practice 2: Multiple Paths



- Establish a course sequence to cover all topics of school algebra
- Provide multiple curricular pathways to ensure success
- Ensure that students are ready for algebra before enrolling them in algebra courses
- Provide opportunities for all students to learn school algebra
- Use the topics of school algebra to inform standards, instructional materials, and assessments



Multimedia Overview:

National Mathematics Advisory Panel



Montana
Office of Public Instruction
Denise Juneau, State Superintendent

opi.mt.gov

Topics of Algebra

- Symbols and Expressions
- Linear Equations
- Quadratic Equations
- Functions
- Algebra of Polynomial
- Combinatorics and Finite Probability



Activity/Discussion/Handout #1



Montana
Office of Public Instruction
Denise Juneau, State Superintendent

Barriers to teaching Algebra

Think-Pair-Share



Video: What Algebra Teachers Need to Know
Discussion



Montana
Office of Public Instruction
Denise Juneau, State Superintendent

opi.mt.gov

Key Concepts

- Build understanding of major algebra topics and connections: symbols and expressions, linear and quadratic equations, functions, algebra of polynomials, combinatorics and finite probability.
 - Classroom instruction must focus on the major topics of algebra recommended by the National Math Panel. Teachers need to make connections across topics and help students understand these connections and build proficiency in these topics.



Montana
Office of Public Instruction
Denise Juneau, State Superintendent

opi.mt.gov

Key Concepts

- Develop students' proficiency in solving problems, which includes problem formulation, problem translation, transformation of equations, and explanation of the steps in problem solving.
 - Students must be proficient in problem-solving skills to achieve success in algebra. Teachers need to provide students with many opportunities to practice problem formulation, translation, and transformation of equations so they can be efficient in solving algebra problems. In addition, students must have experiences with explaining the steps they take to solve problems.



Montana
Office of Public Instruction
Denise Juneau, State Superintendent

opi.mt.gov

Key Concepts

- Enhance teacher understanding of the topics of algebra, the links among those topics, and how to teach those topics, including strategies for addressing student misconceptions in learning algebra.
 - Teachers must understand the mathematics they teach. It is essential that they make connections across topics for students and understand common student misconceptions in order to anticipate where students need additional preparation, practice, and explanation.



Montana
Office of Public Instruction
Denise Juneau, State Superintendent

opi.mt.gov

Sample

- Algebra I Initial Units...What do you notice about the “essential questions” from this sample?
- How do they compare to the level of questions you ask your students?
- How do you currently organize your units of study?

District Perspective on Algebra



Audio clip/Handout #3 and #4/Think-Pair-Share



Montana
Office of Public Instruction
Denise Juneau, State Superintendent

opi.mt.gov

Multiple paths to ensure that all students succeed

Expect that all students will learn school algebra through a coherent progression of topics



Ms. Bracket presentation



Montana
Office of Public Instruction
Denise Juneau, State Superintendent

opi.mt.gov

Multiple Paths

Schools should expect that all students can learn algebra; students who are preparing for college or technical careers should master the topics of school algebra typically addressed in Algebra I and Algebra II courses.



Montana
Office of Public Instruction
Denise Juneau, State Superintendent

Key Concepts

- Establish district-wide expectations for a sequence of courses that encompass all school algebra topics.
 - It is essential that all of the topics of school algebra recommended by the Panel are addressed in traditional Algebra I and II and integrated mathematics courses. No matter what the multi-grade sequence of the major topics, algebra instruction needs to incorporate and emphasize the connections between and logical progressions among the topics.



Montana
Office of Public Instruction
Denise Juneau, State Superintendent

opi.mt.gov

Key Concepts

- Ensure that there is alignment across the major topics of school algebra with content standards, teaching materials, instructional strategies, and assessments.
 - All secondary students should have the opportunity to master the topics typically included in traditional discipline-based Algebra I and Algebra II courses. School districts need to establish alignment across algebra topics, content standards, and assessments. In the classroom, teachers need to use instructional materials and strategies aligned with the topics.



Montana
Office of Public Instruction
Denise Juneau, State Superintendent

opi.mt.gov

Key Concepts

- Ensure that there is a foundational level of preparation and multiple paths for students to succeed in school algebra.
 - Students need adequate preparation in arithmetic to succeed in algebra. The expectation that all students can be successful in learning algebra is fundamental; however, teachers should not assume that all students have the same level of preparation in the principles of arithmetic and basic concepts necessary for learning algebra. Algebra courses should allow for differentiated instruction. Some students may need additional instruction and practice, while others are ready to work at an accelerated pace. Teachers need to understand how students learn to solve equations and word problems and recognize common sources of errors and conceptual misunderstandings.



Montana
Office of Public Instruction
Denise Juneau, State Superintendent

opi.mt.gov

Barriers for students to learn Algebra

Think-Pair-Share



Video: Instructional Strategies for struggling Algebra Students
Discussion



Montana
Office of Public Instruction
Denise Juneau, State Superintendent

Helping Struggling Learners in Algebra



Video



Montana
Office of Public Instruction
Denise Juneau, State Superintendent

Discussion

- *Why is algebra considered the gatekeeper for future course-taking?*
- *What does mastery look like in student performance for each of the topics?*
- *What foundational content pieces are needed for students to be successful in algebra?*



- *How do you prepare students to think abstractly as required in algebra?*
- *What are some misconceptions students have with algebra topics?*
- *How do you address those misconceptions?*



- What strategies are helping struggling students attain success?
- What are the “lateral” options for students who experience difficulty?
- What are the options for advanced students?



Algebra Pathways Inventory: Working With Struggling Algebra Students



Montana
Office of Public Instruction
Denise Juneau, State Superintendent

Additional Resources

- Bradley Witzel video clips (32 total)
Available on the Instructional Innovations website
- Doing What Works: Many additional videos, tools, and templates



Montana
Office of Public Instruction
Denise Juneau, State Superintendent

References/Resources

- Doing What Works: <http://dww.ed.gov/>
- National Mathematics Advisory Panel Final Report:
<http://www2.ed.gov/about/bdscomm/list/mathpanel/report/final-report.pdf>
- Montana Office of Public Instruction Content Standards: <http://www.opi.mt.gov/Curriculum/Index.html>



Montana
Office of Public Instruction
Denise Juneau, State Superintendent

opi.mt.gov